NAMP

Savannah River National Laboratory™
OPERATED BY SAVANNAH RIVER NUCLEAR SOLUTIONS

The Northern Lights Exercise

NWP Nuclear Waste Partnership LLC
An AECOM-led partnership with B&W and AREVA

NBL Program Office
U. S. Department of Energy

INL Idaho National Laboratory

Lawrence Livermore National Laboratory

In Cooperation with our University Partners

OSU Oregon State University

Illinois Institute of Technology

Colorado School of Mines

The University of Iowa

The University of Utah

Clemson University

FIU Florida International University

New Mexico Institute of Mining and Technology

UNM

California State University Long Beach

UNLV

University of California · Irvine

Virginia Commonwealth University

University of Notre Dame

Meet the Presenters…

Mr. Phil Torretto

Mr. Phil Toretto has over 22 years of radiochemistry and radiation detection experience at Lawrence Livermore National Laboratory. He is currently the group leader for LLNL's Bioassay & Radiological Measurements Labs at LLNL and is an active member of DOE's Federal Radiological Monitoring and Assessment Center (FRMAC) Laboratory Analysis Working Group. Before this position, he served as the Nuclear Counting Facility Manager at LLNL. Mr. Torretto received his BS in Chemistry (Radio and Nuclear) for San Jose State University.

Mr. Sean Fournier

Mr. Sean Fournier is a Nuclear Analysis Engineer at Sandia National Laboratories and is an active member in the Federal Radiological Monitoring and Assessment Center (FRMAC) Laboratory Analysis Working Group.

Meet the Presenters…

Ms. Cindy White

Cynthia White is the Director for the Center for Environmental Radiological Laboratory Science (CERLS) at the USEPA's National Analytical Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama. Ms. White has a B.S. in Biology from Auburn University, and over 20 years of radioanalytical experience at commercial and federal laboratories. She has extensive experience in radiochemical method development and validation of routine and more difficult matrices. Ms. White manages the day-to-day operations and duties of the fixed laboratory at NAREL, and directs and supervises a multidisciplinary staff of chemists, scientists, and technicians who perform radiochemical and metals analyses on environmental samples.

Dr. Cong Wei

Dr. Cong Wei serves as a Supervisory Chemist for the U.S. Food and Drug Administration (USFDA) for the Radionuclides/Chemistry Section. He received his Ph.D in Chemistry from Yale University. He has served as the USFDA for 9 years. Along with his research in quick screening technologies and methodologies, he has currently hold various patents and is published in the Journal of Chemical Physics.

Meet the Presenters…

Dr. Robert Jones

Dr. Jones is the Chief of the Inorganic and Radiation Analytic al Toxicology Branch at the Centers for Disease Control and Prevention (CDC). Dr. Jones is also overseeing the development of a variety of radionuclide bioassay methods for emergency and terrorism preparedness and response. These methods will allow CDC to assist the states in responding to a major radiological or nuclear incident and allow for the assessment of contamination and exposure in people and to enable the efficient use of medical countermeasures The Branch is also involved with many long-term (multi-year) local, national or international public health studies. Dr. Jones has 106 publications in the field of analytical chemistry, biophysical chemistry, clinical chemistry and Biomonitoring. He has presented more than 60 national or international invited talks or workshops related to the laboratory aspects of inorganic Biomonitoring as well as chemical and radiological terrorism preparedness and response. Dr. Jones is a Co-Chair of multiple workgroups in the DHS Integrated Consortium of Laboratory Networks (ICLN) and is a member of several CDC, DHS, HHS, FEMA and CLSI national workgroups or committees.

Northern Lights 2016:
A Nuclear Power Plant Accident Exercise

NAMP Webinar Series 5: Environmental & Regulatory Radiochemistry and Special Topics

November 16, 2017

Philip Torretto, LLNL, FRMAC Lab Analysis Division

Lawrence Livermore National Laboratory

LLNL-PRES-728751

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Northern Lights 2016:

- Nuclear Power Plant accident with significant radionuclide release
- Monticello Nuclear Generating Plant in Monticello, MN
- StartEx: t = +21 days post release
- Exercise consisted of 3 pre-start workshops and 4 days of Exercise Play
  - Onsite Play: Camp Ripley Training Center near Little Falls MN

§ Major focus: post-emergency phase leading to recovery phase and transition from DOE to EPA led FRMA

FRMAC Lab Analysis will have a primary role in this scenario

Overarching Exercise Goals

- Respond to Requests and Concerns from State of Minnesota based on scenario and exercise the State-Federal response partnership
- Execute the Transfer of Operational Control of the FRMAC from DOE-led to EPA-led by meeting all the Criteria set in the NRIA
- Integrate Aerial Monitoring System planning and data into on-going FRMAC operations
- ***Exercise the end-to-end laboratory analysis process including field activities, sample management, laboratory activities, data collection/validation***
- Contribute to joint interagency public messaging activities

"End-to-End" Lab Process were Exercised (although out of order)

Analysis Needs, DQO's and Sampling Plans established; Lab assets notified

Samples Collected and Delivered to Hotline/Sample Control; Samples logged in and Chain of Custody established

Analysis Requests Completed and Samples Shipped to labs for analysis

Labs complete analyses as requested and report results

Receive, review and validate laboratory results

Incorporating Offsite Lab Analyses into a full CM Exercise

- Typically not enough time or money to have laboratory analyses performed; most exercises have nationalized offsite lab play
- When analyses have been performed nuclide mixtures and activity levels not been representative of CM scenarios
  - Labs have repeatedly expressed the desire to exercise their analytical capability on complex nuclide mixes relevant to a CM scenario
- Northern Lights scenario offered unique opportunity to incorporate offsite lab analysis and ICLN integration using “more realistic” samples.

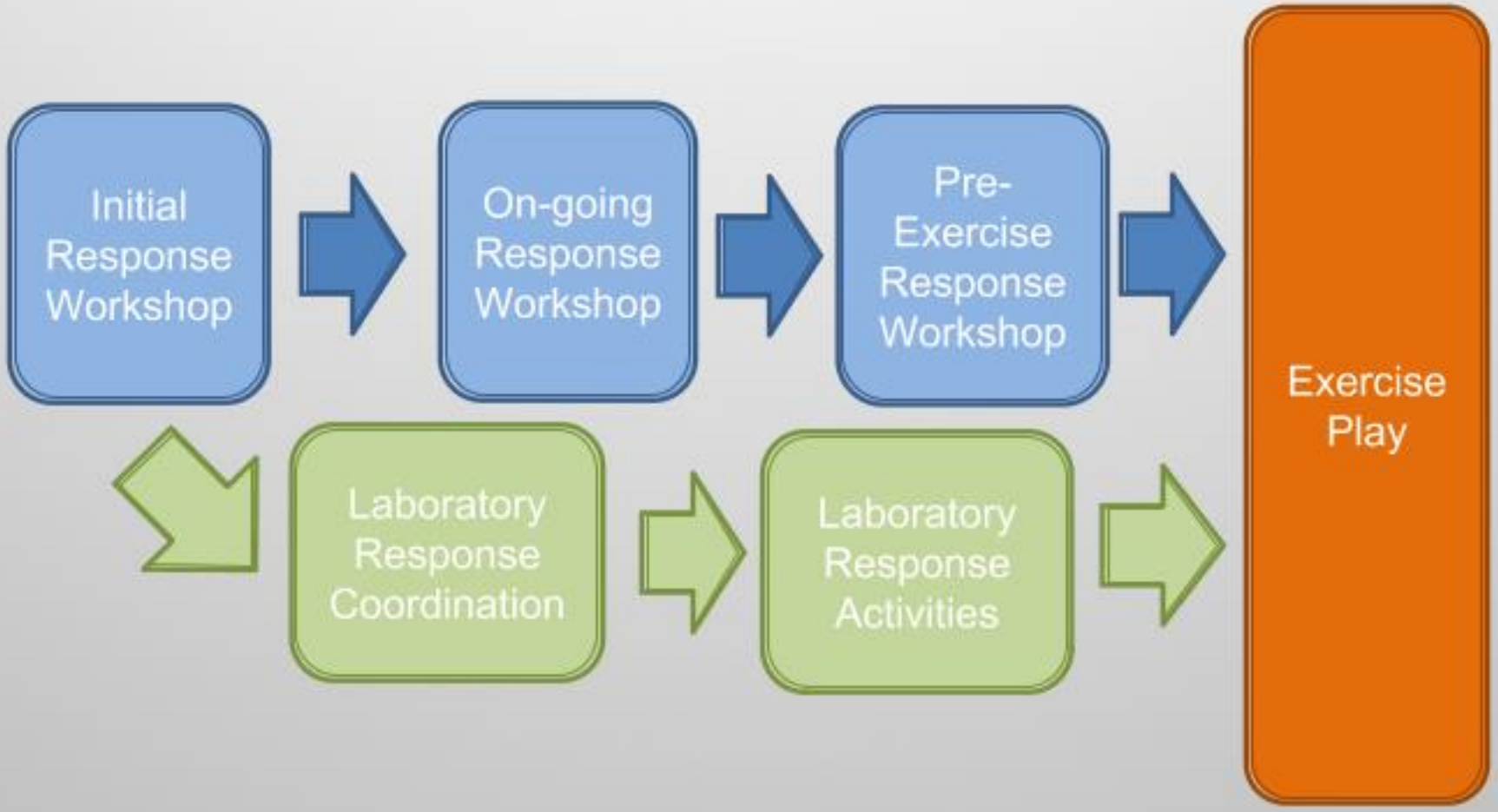
NL16 offered an unprecedented and unique opportunity for offsite Lab play

Laboratory Participation

- 6 DOE/NAMP Labs
  - SRS, SNL, INL, ORISE, WIPP, *LLNL**
- EPA NAREL (ERLN)
- Food Emergency Response Network (FERN) through the ICLN
  - WEAC, MD DoH, NY DoH, TX DoH, WA PHL, WI PHL
- State of Minnesota Public Health Lab
- FRMAC Fly-Away Lab (onsite mobile lab during exercise)

14 labs representing both federal and state agencies

Pre-Exercise Workshop Process



Timeline of NL16 Lab Analysis Play

- **July – Aug** - LLNL responsible for procurement of spiked fresh fission product and blank samples for analysis.
  - matrices: soil, air filter, water and vegetation
- **Aug. 18, 2016** – Initial Response (t = +2 to +7) players developed DQO's and sample plans and brought participating labs on line by activating the ICLN Portal.
- **Sept. 29 2016** – Continuing Response Workshop (t = +14 days) FRMAC Lab Analysis players developed Analysis Requests for each lab; gamma spec and Sr-89/90 analyses on 4 different matrices
- **Sept. 30-Oct 17** – Offsite labs received test samples and performed requested analyses. ICLN portal used to coordinate and facilitate these analyses.
- **Oct. 17 2016** - Offsite labs were required to report their results directly to the FRMAC or through the ICLN Coordinating Office at StartEx
- **Oct. 17 – 20** – Start of Exercise Play; Mobile Lab, Sample Control, Shipping and Validation of Lab Results

Sample Development Scope and Timeline

- PO Received 8/31/16
- HEU irradiated September 6th, 2016 (initiating 3 weeks post accident time line)
- Samples Shipped 9/27/16 via overnight FedEx to 13 US Labs from Atlanta
  - Water, Soil, Air Filter (LLNL supplied), Vegetation (Coffee Grounds)
- 75 Active Samples
  - Activity, 0.0128 mCi or 0.1 mCi
- 135 Blank Samples

Eckert & Ziegler Analytics

Metrics for Primary Objective Complete Analyses and Return Results

Laboratory	Gamma Analyses	Sr-89/90 Analyses	# completed
Idaho National Laboratory	20	6	20
Savannah River Nuclear Solutions	20	6	26
ORISE/AEAV	20	6	26
Sandia National Laboratories	20		20
WIPP	20		20
LLNL Radiochemistry group	*0*	*2*	*2*
MN State Public Health lab	38	10	48
EPA NAREL	20	4	24
Texas DoH	3		3 (qualitative)
Washington PHL	3		3
Maryland DoH	3		3 (qualitative)
WEAC	3		3
Wisconsin PHL	3		3 (qualitative)
New York DoH	3		3

NL16 Successes

- Incorporation of 14 offsite labs and the ICLN into a CM exercise of this magnitude.
- Design and delivery from a commercial vendor of 210 test samples (75 spiked with fresh fission products) in 4 matrices; water, soil, air filter and vegetation.
- Completion of non-routine and complex radiochemical analyses by all participating labs;
  - Successfully redirected samples in 2 days cross country.
  - One DOE lab completed analyses even in the face of Hurricane Mathew that shut their lab down for several days
  - Utilized ICLN portal and the new FRMAC Gamma Spectroscopist position to facilitate the interpretation of complex gamma data.
- Successful utilization of the ICLN portal by FRMAC CM Home Team Lab Manager for coordination of offsite analyses and communication with the various laboratory networks.

NL16 Observations

- Design and Planning
  - Test sample design caused some labs to have issues completing analyses as requested
  - Scenario realistic samples still difficult, if not impossible, to prepare; lead to artificialities incorporating real data in to the greater exercise play.
- Communications
  - ICLN-FRMAC roles, responsibilities and expectations need to be better communicated and documented
  - Miscommunication between Exercise Planner-ICLN Network Coordinator caused 3 FERN labs to be uninformed of the specifics and expectation of their participation; leading to ability to only deliver qualitative results.
  - Feedback from FRMAC LA to Labs during exercises play and post-exercises play on results is highly desired.
- Analysis Request/Reporting/Validation
  - Some detection limits unable to be achieved even by offsite labs.
  - Sr-89/90 isotopic analyses difficult for most labs to complete in the time allotted for this exercise; 2 weeks minimum for chemical processing; 3-4 weeks is more realistic
  - Data flow through the ICLN coordinating offices will cause delays in FRMAC receiving data from ICLN network laboratories.
  - FRMAC LA electronic systems need improvements for more efficient:
    - uploading of data,
    - receipt and validation of the data
    - releasing of data to Assessment Scientists for use in exercise or event

Acknowledgements

- DHS Office of Health Affairs for funding offsite lab play and procurement of test samples
  - Betsy Chacko and Andy Scott
- Eckert and Ziegler for preparation and delivery of 210 test samples on time and within budget
  - Larry Jassin, Eric Brown, Evgeny Taskaev, Levan Tkavadze
- DOE NAMP Laboratory Coordination
  - Berta Oates (Portage) and Cecilia DiPrete (SRNL)
- FERN Lab Network Coordination
  - Cong Wei (WEAC) and Susanne Brooks (FDA)
- ICLN Portal Coordination
  - Marie Socha and Kristin Pasternack
- State of Minnesota
  - Brennen Brunner (MN DPS HSEM) and Jesse Filmore (MDH PHL)

The “Why”

Sandia National Laboratories

Exceptional service in the national interest

Northern Lights 2016

A FRMAC Laboratory Analysis Perspective

FRMAC Laboratory Analysis Working Group

SAND2017-5105 C

RESPONSE · RECOVERY · READINESS · TRIBAL · STATE · LOCAL · FRMAC · Federal Radiological Monitoring and Assessment Center

Operations Excellence Science Engineering RSL REMOTE SENSING LABORATORY

Sandia National Laboratories

Lawrence Livermore National Laboratory

Los Alamos NATIONAL LABORATORY EST. 1943

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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Overview

- FRMAC Lab Analysis Mission Overview
- NL16 Metrics
- NL16 Successes
- NL16 Lessons Learned
  - Analytical Challenges
  - Operational Challenges
  - Data Reporting Challenges
  - Communications Challenges

Federal Radiological Monitoring and Assessment Center (FRMAC)

- **Multi-Agency** response effort conducted in two phases
  - Partners include: DOE, DoD, EPA, FDA, CDC, USDA
- Consequence Management Response Team (CMRT)
  - Phase I
  - Phase II
- Consequence Management Home Team (CMHT)
  - Off-location assets at the national laboratories

MISSION: Assist federal, state, tribal, and local authorities by providing timely, high-quality predictions, measurements, analyses and assessments to promote efficient and effective emergency response for protection of the public and the environment from the consequences of nuclear or radiological incidents.

Federal Radiological Monitoring and Assessment Center (FRMAC)

- Mission: to assist with predictions, measurements, analysis and assessments related to radiological incidents
- Divisions of FRMAC
  - Sampling and Monitoring
  - Assessment
  - Health & Safety
  - Support
  - Liaison
  - Laboratory Analysis

Laboratory Analysis Division Responsibilities

Mobile Labs

Local Fixed Labs

Analysis Needs Are Established

Collect sample/deliver to Hotline/Store Sample

Identify Laboratory

Prepare and ship sample

Receive and review laboratory results

Local Resources

Reachback

NPDN
National Plant Diagnostic Network

FERN
Food Emergency Response Network

ELRN
Environmental LRN

NAHLN
National Animal Health Laboratory Network

RRLN
Radiological Response Laboratory Network

LRN
Laboratory Response Network

ICLN Portal

DLN
Department of Defense Lab Network

Northern Lights 2016 – Laboratory Participation

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NL16 Lessons Learned

Analytical Challenges

- The most likely nuclear emergency scenarios may involve very complex source terms
- Sr-89/90 analysis methods did not meet exercise DQOs
- Requested Lc (critical level) values may be too low for the laboratory to achieve
- Many Labs have limited experience with fresh fission product samples that have complex gamma spectra
- Some labs lack sufficient gamma spec geometries and don't have modeling capabilities to provide quantitative results

NL16 Lessons Learned

Operational Challenges for Labs

- Volatile species of radionuclides are present in realistic sample media. Labs may need special equipment and permits to handle discharge during sample processing
- Some situations require extended shift work (or even 24 hour ops.)
- Some labs' standard operating procedures (SOPs) are not flexible enough to meet the Data Quality Objectives (DQOs) of an emergency response
- Labs can plan for the DQOs in Lab Analysis Manual
  - Google: FRMAC Laboratory Analysis Manual, PDF is the first link
- USDA permits may be required to process some types of samples

NL16 Lessons Learned

Data Reporting Challenges

- Need flexibility to report data for non-detected radionuclides
- It is unclear what a Level I and Level IV data package actually looks like
- It is unclear what records must be uploaded to the Web Portal
- FRMAC Web Portal has bugs to work out
- Labs cannot practice on the Web Portal prior to a drill/exercise

NL16 Lessons Learned

Communication Challenges

- More practice is needed in how FRMAC Lab Management communicates with off-site labs and how they interface with the ICLN
- Off-site labs sometimes feel “out-of-the-loop”
  - ICLN Coordinators need more practice keeping laboratories in the loop
- There is little experience with what an EPA-led FRMAC looks like compared to a DOE-led FRMAC

Be Flexible !!

How Do I Get Involved or Prepare?

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reddintj@nv.doe.gov
(702)295-7220

United States Environmental Protection Agency

Overview of EPA's National Analytical Radiation Environmental Laboratory's (NAREL) Participation in the Northern Lights Exercise

Cynthia White
US Environmental Protection Agency
National Analytical Radiation Environmental Laboratory
(NAREL)
Montgomery, Alabama

November 16, 2017

NAREL's Objectives for NL16

- Integrate NAREL into the exercise's laboratory system and demonstrate the ability to seamlessly input data into the WebPortal
  - Receive and analyze samples
  - Meet MQO's
  - Report results as requested

NL16 Workshops

- Participated in 3 Workshops
  - Initial (Aug 18, 2016)
  - On-going (Sept 29, 2016)
  - Pre-Exercise (Oct 17, 2016)
- Helpful in obtaining valuable information needed to successfully participate in the exercise

Sample Receipt

- NAREL received samples on 9/28/16
- Notified on 9/30/16 to begin work

From: EXERCISE 20160925MonticelloNuclear
To: White, Cindy
Subject: *EXERCISE* FRMAC Status update 9/29/2016
Date: Thursday, September 29, 2016 4:23:43 PM

You have been sent a message from the ICLN Portal Workgroup: EXERCISE 20160925_Monticello_Nuclear by Sean Fournier (sdfourn@sandia.gov).

Northern Lights 2016 Exercise Participants,

Workshop 2 of the Northern Lights 2016 exercise was held today. Samples have been shipped to all participating laboratories and should have arrived. FRMAC Laboratory Analsyis Web Portal notifications will be sent to the laboratories by COB Friday September 30th 2016. **Labs are not to open the sample packages until this notification arrives.**

Sample Type and Analysis

- Received
  - 20 water samples for Gamma (25 mL)
  - 4 water samples for Sr-89/90 (25 mL)

Issues during Sample Receipt

- We did not expect strontium samples
- ARF-025 indicated
  - Analyze for gamma
  - Nuclides were listed as Sr-89/90
  - Count for 100 min
- Contacted FRMAC Rep to clarify and confirm
  - Samples were actually for strontium
  - Count for 60 min

Gamma Analysis

- No applicable calibrated geometry
  - 25 mL liquid as received was diluted to 50 mL to match a calibrated geometry
- Counted for 100 min
- Modified gamma library
- Reported requested and identified nuclides

Gamma Spikes: Average % Recovery by Nuclide

Nuclide	Min (Bq/L)	Max (Bq/L)	Average %R
*Nb-95	105.6	109.4	107.1
Zr-95	104.5	108.5	106.2
Mo-99	90.6	100.3	95.0
Ru-103	99.5	102.5	101.7
I-132	69.1	77.3	72.4
Te-132	79.2	84.3	82.4

*Nb-95 correction calculated offline

Gamma Spikes: Average % Recovery by Nuclide

Nuclide	Min (Bq/L)	Max (Bq/L)	Average %R
Cs-137	89.8	128.5	109.5
Ba-140	97.4	99.5	98.6
La-140	91.3	92.8	92.1
Ce-141	100.5	104.1	102.4
Ce-144	105.3	125.2	115.9
Nd-147	99.5	107.4	103.1

Gamma Blanks

- 14 of the 20 samples were blanks
- Reported requested plus identified nuclides
- All blank results were within ± 2 sigma uncertainty

Strontium

- 10 mL aliquot size diluted to 100 mL
- Analyzed using an Eichrom method
- Counted 60 min

Strontium Data

Sample #	Nuclide	Activity (Bq/L)	Unc (Bq/L)
#1	Sr-89	8670	390
	Sr-90	-55	70
#2	Sr-89	8560	390
	Sr-90	-5	70
#3	Sr-89	2.5	1.9
	Sr-90	-1.7	1.1
#4	Sr-89	0.4	1.5
	Sr-90	-0.73	0.95

Strontium Samples

- Waited 7 days instead of 10 between 1st and 2nd counts in order to meet TAT
- No reference values provided
- All blank results were within ± 2 sigma uncertainty

What went wrong?

- Radiochemistry Data Coordinator on vacation
- RDC replacement didn't have a WebPortal account
- Data uploaded to the wrong place on the WebPortal

What went right?

- Receipt of samples, although we weren't expecting strontium, communication with FRMAC Rep solved the issues
- Able to analyze gamma samples even though not typical radionuclide mix
- Didn't cross contaminate the laboratory

FRMAC Lab Analysis Manager Shadowing

- Shadowed FRMAC Lab Analysis Manager at the Camp Ripley site during the exercise
- Mark Allen, Sandia National Laboratories
- Learned a lot
  - FRMAC process
  - Interaction with other agencies

Future Exercises

- Accept more samples
- Different matrices

Thanks

- Sandia National Laboratories staff
- Dr. John Griggs, USEPA/NAREL
- Dr. Keith McCroan, USEPA/NAREL
- NAREL staff

ICLN FERN Participation and Lessons Learned: Northern Lights Exercise

2017 NAMP Webinar

Cong Wei, Ph.D.

Food and Drug Administration
Office of Regulatory Affairs
Winchester Engineering and Analytical Center

Disclaimer

- Reference to any commercial materials, equipment, or process does not, in any way, constitute approval, endorsement, or recommendation by the US Food and Drug Administration
- All views and opinions expressed throughout the presentation are those of the presenter and do not necessarily represent views or official position of US Food and Drug Administration and FERN

FERN Participation

- Six Food Emergency Response Network (FERN) Laboratories
- Gamma-ray Analysis
  - Quantitative
  - Qualitative
- Sr-89/Sr-90

Lessons Learned

- Communication
- Analytical Capability
- Safety
  - Laboratory Infrastructure
    - Laboratory Personnel Safety
    - Public Safety

Communication

- May 19, 2016 - ICLN radiological subgroup meeting, Northern Lights Exercise was introduced
- June 10, 2016 – FDA FERN National Program Office (NPO) communicated with the FERN radio-analytical laboratories on the exercise
- June 10, 2016 to July 13, 2016 – FERN laboratories' responses, questions, and answers about the exercise
- July 13, 2016 – First FERN conference call, discussions about the exercise, fresh fission product was mentioned
- August 30, 2016 - FDA FERN NPO email communication to FERN Laboratories on the exercise date/time frame, sample matrix/amount, and data reporting mechanism
- September 30, 2016 – Second FERN conference call. More detailed discussions on the exercise and concerns on safety
- October 4, 2016 – FRAMC conference call with participating laboratories

Participations

- Quantitative gamma-ray analysis – 3 FERN laboratories
- Qualitative analysis – 3 FERN laboratories
- Sr-89/90 – Participations were limited due to lack of setup for handling and monitoring volatile radioisotopes

Analytical Capability and Safety

- A laboratory's emergency response capability is dependent on:
  - Analytical capability, e.g., laboratories have the analytical capability of analyzing Sr-90 or Sr-89/90 but participation was limited due to lack of laboratory setup for handling certain radioisotopes co-existed in the sample
  - Laboratory's safety infrastructure for
    - Personnel and public safety - system setup for handling and monitoring volatile radioisotopes

Lessons Learned

- Communication – Focus should not only be on analytical capability aspects but also safety related issues, e.g., radiation safety officers and industrial hygienists should also be included in the communication
- Laboratory Infrastructure
  - Procedures and safety measures for handling samples containing volatile elements/molecules
  - Monitoring devices

Acknowledgment

- Northern Lights Exercise Planning and Field Management Team
- FERN NPO and participating laboratories


FDA
U.S. FOOD & DRUG
ADMINISTRATION

2016 Northern Lights NPP Radiological Laboratory Exercise

Robert L. Jones, PhD

2017 NAMP Webinar

National Center for Environmental Health
Division of Laboratory Sciences

Northern Lights Lab Exercise

Ø **Radiological Laboratory Exercise (CDC):**

- Assess Analytical Throughput, Laboratory Quality Objectives, Sample Tracking and Reporting on real spiked samples.

- Extensive use and testing of the CDC/DLS LIMS (and testing of the ICLN Minimum Data Elements format)

Radiation Diagnostics
Tool Effectiveness vs. Type of Incident

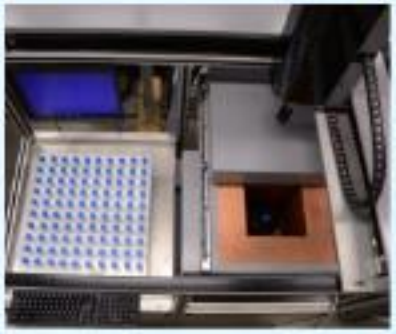
Type of Incident	Exposure (Biodosimetry)	Contamination (Bioassay)
Improvised Nuclear Device (IND)	**Effective** (shine)	**Effective** (fallout)
Nuclear Power Plant (NPP)	Limited	**Effective** (fallout)
Radiation Dispersal Device (RDD)	Limited	**Effective**
Radiation Exposure Device (RED)	**Effective**	Not useful

Biodosimetry determines a "past" radiation dose from an "exposure" incident. (HHS/BARDA Diagnostic test Development)

Bioassay determines "past, current and future" radiation doses from a "contamination" incident. (CDC Diagnostic test Development)

CDC's Urine Radionuclide Screen

Urine "Spot" Sample

- **Gamma Radionuclide Screen**
  - 
  - **Gamma Spectrometry Quantification**
    - 
- **Alpha/Beta Radionuclide Screen/Quantification**
  - 
  - **Alpha Spectrometry Quantification**
    - 
- **Alpha (Long Lived) ICP-MS Screen**
  - 
  - **Mass Spectroscopy Quantification**
    - 
  - **High Resolution Mass Spectroscopy Quantification**
    - 

CDC'S Exercise Goals

Test the CDC's ability, for 30 spot urine samples, to:

- receive, login, and process
- analyze (screen, identify and quantify)
- perform analytical quality control
- report analytical results
- use the Division database to:
  - order tests
  - manage sample test and result information
  - produce QC charts/validating analytical run QC
  - produce standard CLIA compliant reports
  - generate ICLN MDE format output files

CDC'S Exercise 2016

Test the CDC Bioassay lab's ability to:

- Analyze 30 Samples
- Subset randomly spiked (low and high levels) with:
  - Pu-239
  - Uranium
  - Cs-137
- Analysis of:
  - Gross alpha/beta
  - Sr-90
  - Gross Gamma
  - Cs-137

Actinide Screen
Uranium (total)
Uranium Isotope Ratios
Pu-239

Results - Gross □/□

Spike values:

Pu-239 low = 15 pg/L and high = 75 pg/L
Uranium low = 50 pg/L and high = 250 pg/L
Cs-137 low = 500 Bq/L and high = 2000 Bq/L

Gross a (CPS/L)	Mean	SD	
Low	<LOD		n=10
High	<LOD		n=10
Blank pool	<LOD		n=10

Gross b (CPS/L)			
Low b	299	17.1	n=10
High b	2450	51.9	n=10
Blank pool b	51.7	7.4	n=10

Results – Pu-239 and Uranium

Spike values: Pu-239 low = 15 pg/L and high = 75 pg/L
Uranium low = 50 pg/L and high = 250 pg/L

Pu-239, pg/L	Mean	SD	
Low Spike	14.6	0.26	n=10
High Spike	72	0.89	n=10
No Pu Spike	<LOD		n=10

Uranium, pg/L	Mean	SD	
Low Spike	59	1.42	n=10
High Spike	281	5.68	n=10
No U Spike	<LOD		n=10

Issues/Lessons Identified

- **Gross Alpha/Beta Screen identified elevated levels in the Cs-137 spiked samples**
- **The Actinide screen identified Pu-239 and Uranium in the spiked samples (Np, Am and Th all non-detects).**
- **The Gross Gamma screen identified the elevated levels of Cs-137 in the spiked samples**
- **The Uranium Isotope ratio results show all "natural" ratios**
- **The Sr-90 results were all <LOD**
- **The Po-210 results were all <LOD**
- **The HPGe results were unavailable due to Instrumentation issues**

Exercise "Take-aways"

- Exercise started on 10/11/2016 at 8:00 AM
- 30 samples (10 low and 10 high spikes)
- 3 radionuclides in the spikes
- All data reported by 1:00 PM on 10/12 (**29 hours**)
- Uranium Isotope ratio data reported on 10/12 at 10:34 AM only for 10 samples [High spike] (after the total uranium analysis was run on 10/11)
- 8 analytical methods used
- 6 analytical technologies used
  - NaI, LSC, alpha spec, Q-ICP-MS, HR-ICP-MS and HPGe
- 7 analytical staff

Summary

- CDC realized most of its goals for participating in the Northern Lights (independent side) Exercise.
- CDC's methods were effective in identifying and quantifying the radionuclides of interest.
- CDC determined that it can perform these analyses on 30 samples in 1 to 2 days.
- A number of issues were identified that can be used to improve performance in these and other methods and future exercises or responses.

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Thank you

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